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PROSPECTS AND PROBLEM AREAS FOR THE DEVELOPMENT OF TELECOMMUNICATIONS IN THE EUROPEAN SATELLITES 1964-75

CIA/RR EP 65-68

August 1965

CENTRAL INTELLIGENCE AGENCY

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FOREWORD

This publication has been prepared for presentation [redacted] and represents an updating of the publication prepared for the 1964 conference, CIA/RR EP 64-21, Prospects and Problem Areas for the Development of Telecommunications in the European Satellites, 1959-75, April 1964, SECRET. Participants in the conference include [redacted]

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PROSPECTS AND PROBLEM AREAS FOR THE DEVELOPMENT OF TELECOMMUNICATIONS IN THE EUROPEAN SATELLITES 1964-75

Summary

The buildup of national and intra-Bloc telecommunications facilities and services in the European Satellites since early in 1964 has fallen short of plan goals. Although a number of Vesna-type microwave radio relay lines and a 4-tube coaxial cable line have been completed, a serious gap persists between the operating levels and design capacities of these new high-capacity transmission systems. Currently, such systems are carrying only television, with their use for telephone and telegraph services still awaiting installation of associated carrier-frequency multiplex equipment.

The inability to exploit fully the telephone channel capacities of these broadband transmission facilities, coupled with shortages of modern telephone exchange equipment, has restricted the development of national and intra-Bloc telephone networks. For example, the intra-Bloc semiautomatic telephone network, scheduled for completion late in 1964, probably will not become operational until mid-1966. Furthermore, much of the increase in the number of telephone subscribers in the national networks during the past 18 months has been achieved by stopgap measures, including the overloading of existing exchange facilities and the extensive use of party lines.

The pace of developments in telecommunications during the 1966-75 period will continue to fall below planned levels until the European Satellites are able to develop and produce needed modern telecommunications equipment. Continued failures to cope with the technology underlying mass production of high-capacity carrier systems and automatic telephone exchange equipment probably will force increased reliance on Free World sources.

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I. Developments Through Mid-1965

A. Organization for Cooperation Among Socialist Countries in the Fields of Post and Communications (OSS)

Since early in 1964, European Satellite members of OSS, particularly Czechoslovakia, Poland, East Germany, and Rumania, have continued to upgrade their domestic and intra-Bloc telecommunications networks. By far, the most significant achievement during the past 18 months has been the completion, in November 1964, of the 4-tube coaxial cable line connecting the USSR, Poland, Czechoslovakia, and East Germany. Despite the fanfare associated with the opening of this new line, its completion was more than 2 years behind schedule. Furthermore, only two of the four coaxial tubes are being used and only television is being passed at this time. Use of this facility for telephone and telegraph traffic awaits the installation of the necessary carrier-frequency multiplexing equipment.

In July of 1965 the Sixth Ministerial Conference of OSS was held in Peking. Little is known of the results of this meeting, but the conference was to focus on future plans for development of telecommunications. The role of communications satellites probably was included in these discussions as the USSR was scheduled to present a paper relating its experiences with Molniya I, the first Soviet communications satellite, launched in April 1965. During the meeting, Cuba's request for full membership status was honored, enlarging the membership to 13 countries. Rumania will be host to the Seventh Ministerial Conference some time in 1967.

B. System Development

1. High-Capacity Transmission Systems

The current status of high-capacity microwave radio relay and cable lines in the European Satellites is shown on the accompanying map. Vesna-type microwave radio relay or 4-tube coaxial cable lines, or both, connect all European Satellite countries with the USSR, but such facilities are not yet available to interconnect all adjacent Satellite countries. Attainment of this major goal probably will be delayed until the end of 1966.

By mid-1965 there were nearly 3,000 kilometers (1,900 miles) of Vesna-type microwave radio relay and about 1,100 kilometers (700 miles) of 4-tube coaxial cable lines in operation in the European Satellites. Although these data are impressive in terms of route kilometers, they do not reflect the serious disparity that exists between the designed capacity of these lines and their current operational capacity. The Vesna-type system, for example, is designed to provide 6 radio frequency (RF) trunks (5 operational and 1 standby), each capable of carrying 600 telephone channels or 1 television program. Yet, these systems in the European Satellites are using only two RF trunks, one for television transmissions and the other for standby. It is not

expected that Vesna-type microwave lines will be used for telephone traffic until sometime in 1966. At that time a third RF trunk probably will be added to a number of lines to carry from 60 to 120 telephone channels. A similar disparity is evident in the use of the new 4-tube coaxial cable line. This line has a capacity of 1,920 telephone channels plus 2 television channels, but its use for telephone traffic also will be delayed until 1966. Even then this line probably will be equipped to handle no more than 60 to 120 channels. In spite of the fact that neither the Vesna-type microwave nor the 4-tube coaxial cable lines were designed to operate at their rated capacities upon installation, it is unlikely that their initial operational capacities would have been intentionally scaled to such low levels. Such restricted use serves to underscore the problems that the European Satellites are facing in their attempts to deploy a base of high-capacity transmission systems, largely as a result of shortages of carrier equipment.

2. Telephone Systems

A chronic lag persists in the development of both intra-Bloc and national telephone systems. During the past 18 months, little progress has been made toward the attainment of goals for the establishment of a semiautomatic telephone network that would interconnect the capital cities of the European Satellites and at the same time serve to speed telephone service with Western European countries. Although the terminals of the network in East Berlin and Prague became operational late in 1964, the installation of MN-60 crossbar exchanges at the Warsaw and Moscow terminals, also scheduled for 1964, evidently is not yet completed. This delay probably can be attributed to shortages of equipment and subsequent failures in meeting delivery dates for equipment.

Shortages of modern telephone exchange equipment also appear to be the primary factor that has impeded the development of national telephone systems. In spite of ambitious plans calling for a sizable expansion in the number of telephone subscribers in all Bloc countries during the 1960-80 period, progress to date has been below expectations. Moreover, a significant portion of the increase in telephone subscribers has been achieved through overloading of existing facilities and the extensive use of party lines. It is not surprising, therefore, that a substantial backlog of telephone subscriber applications exists in each of the European Satellites.

Although the employment of modern crossbar equipment has been acknowledged as the key to expanding telephone coverage and service, its development and production has been a longstanding problem in the European Satellites. Since at least 1959, East Germany, Czechoslovakia, and Hungary have sought to develop such equipment, but only Czechoslovakia has achieved a modicum of success with its MN-60 exchange. Hungarian progress has been limited to the development of a 600-line exchange that was scheduled for operational use in June 1965.

In view of these shortcomings, both Rumania and Hungary already have turned to the West to meet some of their critical needs for exchange equipment. Thus far in 1965, Rumania has contracted with Belgium for the purchase of crossbar exchanges to be installed in Bucharest and 12 other cities and for the construction of a plant for domestic production of such equipment. By 1970 this plant is scheduled to have an annual capacity of 100,000 lines of crossbar exchange equipment. Early in 1965, Hungary concluded contracts with Austria and West Germany for the import of 50,000 lines of crossbar equipment -- 40,000 lines to be installed in Budapest and 10,000 lines in Pecs -- and for manufacturing rights for the production of such equipment. Inasmuch as Hungary is one of the major producers of telephone exchanges in the Bloc, these contracts in themselves underscore the seriousness of the problem and probably foreshadow an increased reliance on the West for equipment and production technology by all European Satellite countries.

3. Telegraph Systems

During the past 18 months the European Satellites have stressed the further development of national telegraph systems. Although improvements were expected in the operation of the fully automated intra-Bloc general telegraph (GENTEX) network, including the establishment of additional terminals and its full integration with similar networks in Western Europe, these changes have not materialized. In fact, the only significant development in intra-Bloc telegraph service has been the establishment in July 1965 of a facsimile network known as Photo International. Members of this network include the USSR and all the European Satellites, except Rumania and Bulgaria. With its central dispatch office in Prague, facilities of this network automatically route news photographs to the news agencies of member countries.

Improvements in national telegraph systems have focused on speeding public telegraph service through the introduction of automatic telegraph exchanges and additional transit centers. A continuing effort also has been made to extend the coverage and broaden the base of the subscriber telegraph (TELEX) networks in all Bloc countries. As might be expected, East Germany has surpassed all the other European Satellites in these developments. Its TELEX network, for example, now consists of more than 5,000 subscribers, a figure greater than the total number of TELEX subscribers in all of the other European Satellites. East German plans in this field envision that by 1970 every enterprise with 200 or more employees will have at least one TELEX connection and that the network will be served by 8 fully automated transit centers. Currently, the network operates with only two such centers, one at East Berlin and the other at Leipzig.

4. Television

The European Satellites have continued to enlarge their domestic television transmission and reception base. New or improved television transmitters have been installed in nearly all of the European Satellites, and concerted attempts have been made to make television a truly Bloc-wide propaganda medium. These developments also have served to foster the further improvement of Intervision, the intra-Bloc television network. Since early in 1964, facilities of this network have taken on a more permanent form with the replacement of a number of temporary connections by new microwave and coaxial cable lines. These new facilities have given the Intervision network greater routing flexibility and have permitted an increase in the number and quality of programs exchanged. The more than 400 programs exchanged within Intervision as well as 150 programs exchanged with its Western European counterpart, Eurovision, in the first half of 1964, for example, nearly equals the total number of such exchanges throughout all of 1963. Interconnections for the Intervision-Eurovision exchanges now are available at the following locations:

Tallinn, USSR, to Helsinki, Finland
Pecs, Hungary, to Belgrade, Yugoslavia
Sopron, Hungary, to Vienna, Austria
Bratislava, Czechoslovakia, to Vienna, Austria
Brocken, East Germany, to West Hartz Mts., West Germany
Marlow, East Germany, to Copenhagen, Denmark

Additional Intervision-Eurovision connections are being considered between Prague, Czechoslovakia, and Nuremberg, West Germany; and between Timisoara, Rumania, and Belgrade, Yugoslavia.

A number of the European Satellites have announced preliminary plans for the introduction of color television. The transmission of color television programs in Czechoslovakia, for example, has been scheduled for 1970, and similar undertakings in Poland and East Germany have been earmarked for somewhat earlier dates. Early in 1965, color television test transmissions were completed between Poland and the USSR, but no technical data are available on the results of the test other than that the 4-tube coaxial cable was used as the transmission line.

The introduction of color television in the European Satellites is contingent on progress made by the USSR. The Soviet leadership in color television, however, is somewhat illusory, in that the USSR does not possess an indigenously developed system. Motivated by the need to overcome this handicap as economically and expeditiously as possible, and perhaps by underlying political aims, the USSR in March 1965 concluded an agreement with France for cooperation in the field of color television based on the use of the French sequence and memory (SECAM) system. Recent reports suggest that the USSR intends to introduce

color television service in 1967 and 1968. Even if this schedule is adhered to, initial service probably will be limited to test programs in the Moscow and Leningrad areas. Moreover, a significant number of color television receivers probably will not be available in the USSR before 1975.

As might be expected, all of the European Satellites have announced that they will follow the lead of the USSR in accepting the SECAM system. There is some question, however, whether East Germany will, in fact, select the SECAM system in view of West German plans for the adoption of a phase alternation by line (PAL) color system. If East Germany were to choose SECAM, it would be forced to sacrifice the compatibility of television standards that presently exist with West Germany. Irrespective of this problem, color television service on any significant scale in the European Satellites cannot be expected before the 1975-80 period.

II. Plans and Prospects Through 1975

Since 1959 the European Satellites have made progress in establishing the basic framework for a modern, integrated telecommunications system. Serious problems still persist, however, particularly in the areas of equipping new microwave and coaxial cable lines with high-capacity carrier systems and in automating and expanding telephone and telegraph facilities.

A. Transmission Systems

Through 1970, efforts in the transmission field will be devoted to increasing the capacity of existing microwave and coaxial cable lines. In addition, a new coaxial cable line connecting East Berlin, Warsaw, and the USSR probably will be constructed as well as several new Vesna-type microwave lines. A small-diameter coaxial cable system that has been under development for several years probably will be introduced in Czechoslovakia, East Germany, and Poland, but its use will be restricted to the national networks of these countries. After 1970 a 6,000-megacycle microwave system known as Druzhba probably will make its first appearance in the European Satellites. This new system -- which is a joint development project of Hungary and the USSR, with Hungary having the production responsibility -- will undergo experimental tests on a 400-kilometer route (260 miles) in the USSR in 1966-67. Although series production of Druzhba is scheduled for 1969, it is likely that the first such units will be allocated to the USSR.

The successful testing of the first Soviet communications satellite, Molniya I, raises the possibility that the European Satellites will participate in a communications satellite network with the USSR. This medium has little applicability to the overall communications needs of the European Satellites, but political and prestige factors may override practical considerations.

B. Telephone and Telegraph Systems

The expansion and automation of domestic and intra-Bloc telephone service will be the dominant goal of the European Satellites throughout the 1966-75 period. With respect to intra-Bloc service, first priority will be given to completing the semiautomatic telephone network by no later than mid-1966. This network is scheduled for conversion to fully automatic operation by 1974, but attainment of this target date is unlikely. Any substantial improvement in national telephone service will require large investments in automatic urban and interurban exchanges and the conversion of existing manual exchanges to semiautomatic and automatic operation.

Inasmuch as goals for the establishment of the GENTEX network already have been met, improvements in intra-Bloc telegraph service will be keyed to the addition of new terminals so as to extend the coverage of the network. National telegraph development will stress expansion of individual TELEX networks to accommodate more subscribers and to provide automatic connections between the networks of contiguous countries. Although experiments are underway for the introduction of data transmission systems, their use in the European Satellites is not anticipated for at least 5 years, at which time they will be used primarily to meet national requirements.

C. Problems

The availability of high-capacity carrier systems and automatic exchange equipment will largely determine the pace at which the European Satellites move toward the attainment of goals for the development of telecommunications. Shortages of such equipment have stymied execution of past programs, and little discernible gain has been made in the past 18 months in overcoming chronic problems in development and production. The inability to cope with these problems already has resulted in increased reliance on Free World sources of supply, and this trend is likely to continue until such time as there is considerable improvement in indigenous development and production capabilities.

PROSPECTS AND PROBLEM AREAS FOR THE DEVELOPMENT OF TELECOMMUNICATIONS IN THE EUROPEAN SATELLITES 1964-75

August 1965

FOREWORD

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25X1C [redacted]

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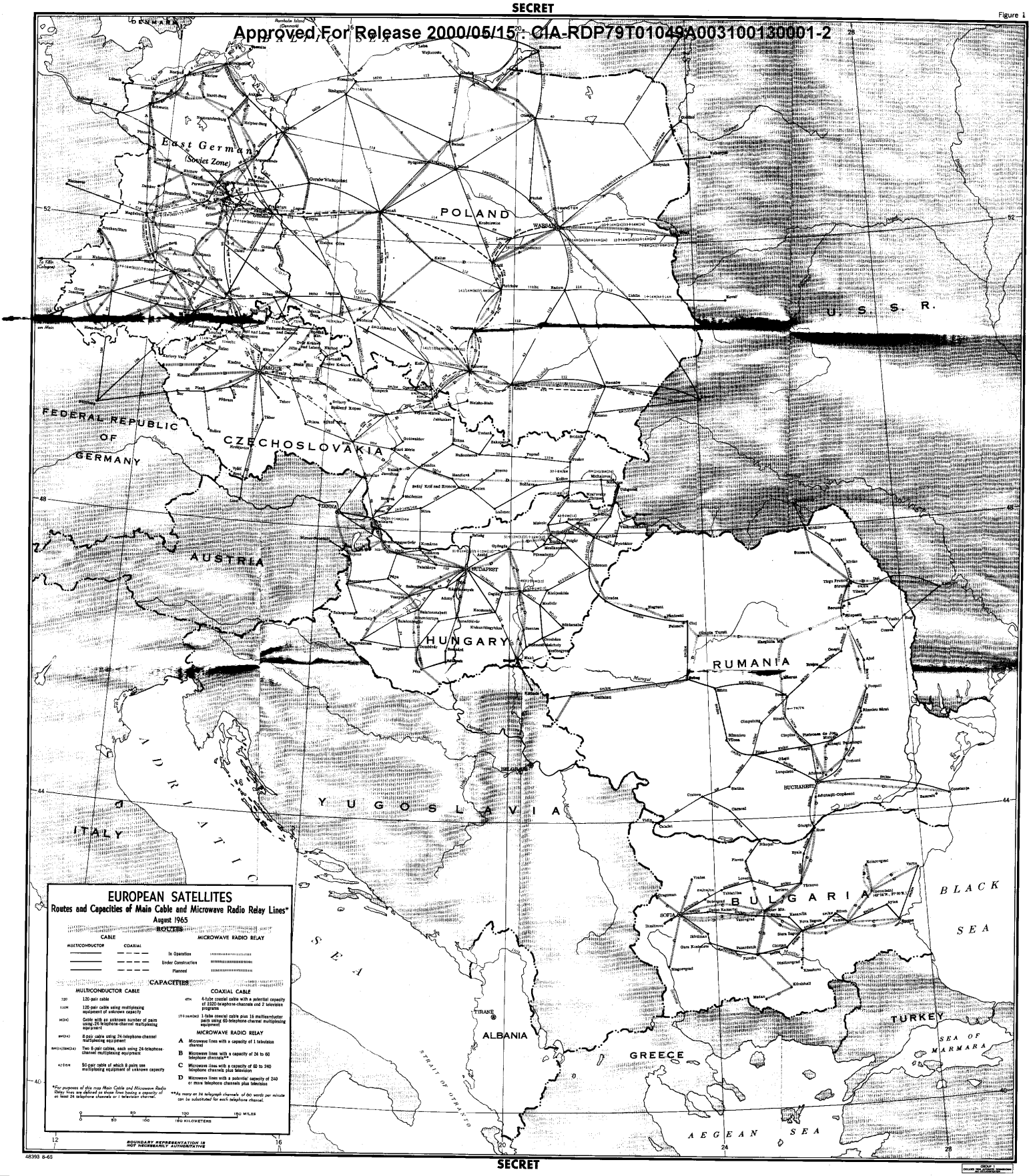

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Improvements in national telegraph systems have focused on speeding public telegraph service through the introduction of automatic telegraph exchanges and additional transit centers. A continuing effort also has been made to extend the coverage and broaden the base of the subscriber telegraph (TELEX) networks in all Bloc countries. As might be expected, East Germany has surpassed all the other European Satellites in these developments. Its TELEX network, for example, now consists of more than 5,000 subscribers, a figure greater than the total number of TELEX subscribers in all of the other European Satellites. East German plans in this field envision that by 1970 every enterprise with 200 or more employees will have at least one TELEX connection and that the network will be served by 8 fully automated transit centers. Currently, the network operates with only two such centers, one at East Berlin and the other at Leipzig.

4. Television

The European Satellites have continued to enlarge their domestic television transmission and reception base. New or improved television transmitters have been installed in nearly all of the European Satellites, and concerted attempts have been made to make television a truly Bloc-wide propaganda medium. These developments also have served to foster the further improvement of Intervision, the intra-Bloc television network. Since early in 1964, facilities of this network have taken on a more permanent form with the replacement of a number of temporary connections by new microwave and coaxial cable lines. These new facilities have given the Intervision network greater routing flexibility and have permitted an increase in the number and quality of programs exchanged. The more than 400 programs exchanged within Intervision as well as 150 programs exchanged with its Western European counterpart, Eurovision, in the first half of 1964, for example, nearly equals the total number of such exchanges throughout all of 1963. Interconnections for the Intervision-Eurovision exchanges now are available at the following locations:

Tallinn, USSR, to Helsinki, Finland
Pecs, Hungary, to Belgrade, Yugoslavia
Sopron, Hungary, to Vienna, Austria
Bratislava, Czechoslovakia, to Vienna, Austria
Brocken, East Germany, to West Hartz Mts., West Germany
Marlow, East Germany, to Copenhagen, Denmark

Additional Intervision-Eurovision connections are being considered between Prague, Czechoslovakia, and Nuremberg, West Germany; and between Timisoara, Rumania, and Belgrade, Yugoslavia.

A number of the European Satellites have announced preliminary plans for the introduction of color television. The transmission of color television programs in Czechoslovakia, for example, has been scheduled for 1970, and similar undertakings in Poland and East Germany have been earmarked for somewhat earlier dates. Early in 1965, color television test transmissions were completed between Poland and the USSR, but no technical data are available on the results of the test other than that the 4-tube coaxial cable was used as the transmission line.

The introduction of color television in the European Satellites is contingent on progress made by the USSR. The Soviet leadership in color television, however, is somewhat illusory, in that the USSR does not possess an indigenously developed system. Motivated by the need to overcome this handicap as economically and expeditiously as possible, and perhaps by underlying political aims, the USSR in March 1965 concluded an agreement with France for cooperation in the field of color television based on the use of the French sequence and memory (SECAM) system. Recent reports suggest that the USSR intends to introduce

color television service in 1967 and 1968. Even if this schedule is adhered to, initial service probably will be limited to test programs in the Moscow and Leningrad areas. Moreover, a significant number of color television receivers probably will not be available in the USSR before 1975.

As might be expected, all of the European Satellites have announced that they will follow the lead of the USSR in accepting the SECAM system. There is some question, however, whether East Germany will, in fact, select the SECAM system in view of West German plans for the adoption of a phase alternation by line (PAL) color system. If East Germany were to choose SECAM, it would be forced to sacrifice the compatibility of television standards that presently exist with West Germany. Irrespective of this problem, color television service on any significant scale in the European Satellites cannot be expected before the 1975-80 period.

II. Plans and Prospects Through 1975

Since 1959 the European Satellites have made progress in establishing the basic framework for a modern, integrated telecommunications system. Serious problems still persist, however, particularly in the areas of equipping new microwave and coaxial cable lines with high-capacity carrier systems and in automating and expanding telephone and telegraph facilities.

A. Transmission Systems

Through 1970, efforts in the transmission field will be devoted to increasing the capacity of existing microwave and coaxial cable lines. In addition, a new coaxial cable line connecting East Berlin, Warsaw, and the USSR probably will be constructed as well as several new Vesna-type microwave lines. A small-diameter coaxial cable system that has been under development for several years probably will be introduced in Czechoslovakia, East Germany, and Poland, but its use will be restricted to the national networks of these countries. After 1970 a 6,000-megacycle microwave system known as Druzhba probably will make its first appearance in the European Satellites. This new system -- which is a joint development project of Hungary and the USSR, with Hungary having the production responsibility -- will undergo experimental tests on a 400-kilometer route (260 miles) in the USSR in 1966-67. Although series production of Druzhba is scheduled for 1969, it is likely that the first such units will be allocated to the USSR.

The successful testing of the first Soviet communications satellite, Molniya I, raises the possibility that the European Satellites will participate in a communications satellite network with the USSR. This medium has little applicability to the overall communications needs of the European Satellites, but political and prestige factors may override practical considerations.

B. Telephone and Telegraph Systems

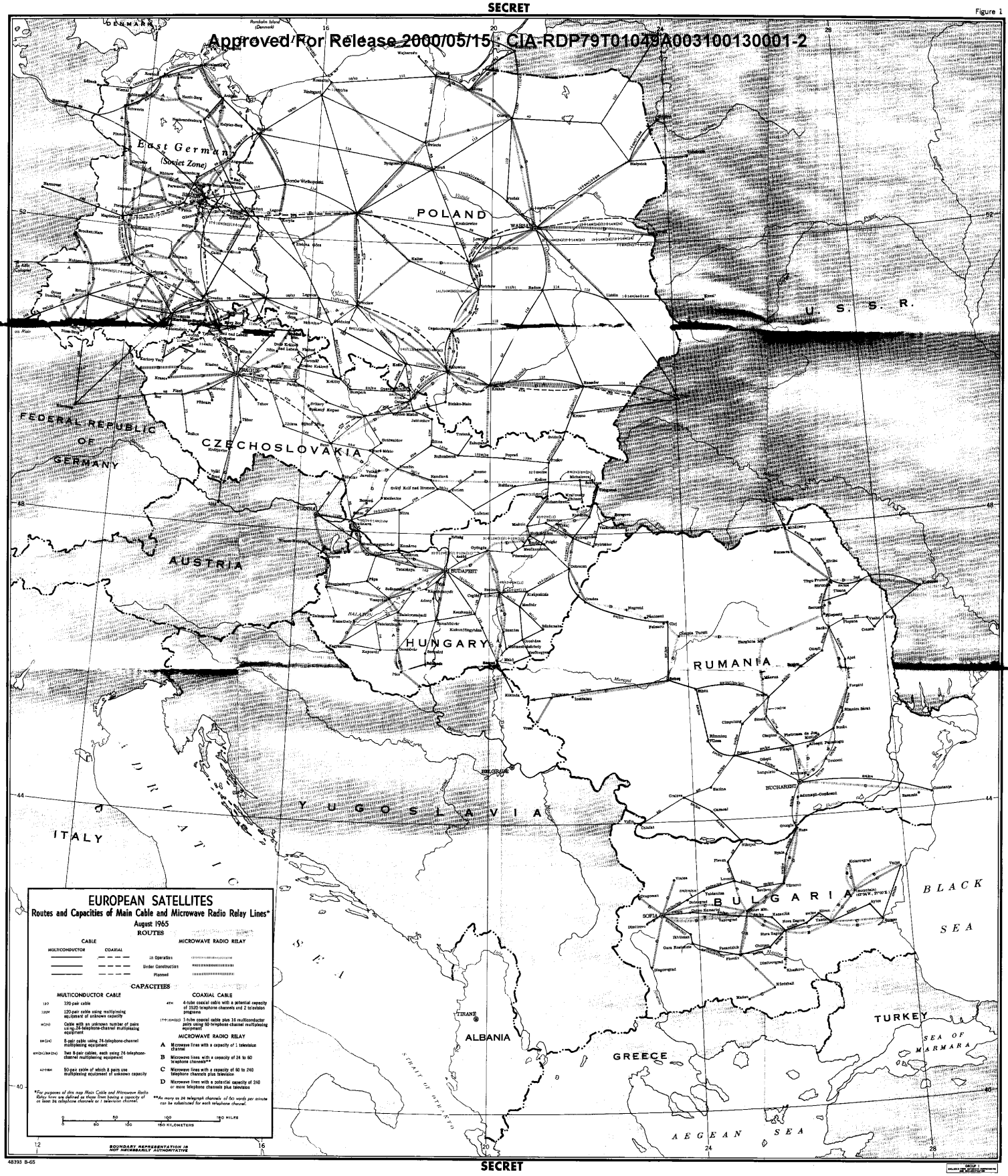
The expansion and automation of domestic and intra-Bloc telephone service will be the dominant goal of the European Satellites throughout the 1966-75 period. With respect to intra-Bloc service, first priority will be given to completing the semiautomatic telephone network by no later than mid-1966. This network is scheduled for conversion to fully automatic operation by 1974, but attainment of this target date is unlikely. Any substantial improvement in national telephone service will require large investments in automatic urban and interurban exchanges and the conversion of existing manual exchanges to semiautomatic and automatic operation.

Inasmuch as goals for the establishment of the GENTEX network already have been met, improvements in intra-Bloc telegraph service will be keyed to the addition of new terminals so as to extend the coverage of the network. National telegraph development will stress expansion of individual TELEX networks to accommodate more subscribers and to provide automatic connections between the networks of contiguous countries. Although experiments are underway for the introduction of data transmission systems, their use in the European Satellites is not anticipated for at least 5 years, at which time they will be used primarily to meet national requirements.

C. Problems

The availability of high-capacity carrier systems and automatic exchange equipment will largely determine the pace at which the European Satellites move toward the attainment of goals for the development of telecommunications. Shortages of such equipment have stymied execution of past programs, and little discernible gain has been made in the past 18 months in overcoming chronic problems in development and production. The inability to cope with these problems already has resulted in increased reliance on Free World sources of supply, and this trend is likely to continue until such time as there is considerable improvement in indigenous development and production capabilities.

Figure 1



EUROPEAN SATELLITES

Routes and Capacities of Main Cable and Microwave Radio Relay Lines*

August 1965

ROUTES

CABLE		MICROWAVE RADIO RELAY	
MULTICONDUCTOR	COAXIAL		
———	— — —	In Operation	
———	— — —	Under Construction	
———	— — —	Planned	

CAPACITIES

MULTICONDUCTOR CABLE

120	120-pair cable
120M	120-pair cable using multiplexing equipment of unknown capacity
M(24)	Cable with an unknown number of pairs using 24-telephone-channel multiplexing equipment
6M(24)	6-pair cable using 24-telephone-channel multiplexing equipment
6M(24)/3M(24)	Two 6-pair cables, each using 24-telephone-channel multiplexing equipment
42+9M	50-pair cable of which 8 pairs use multiplexing equipment of unknown capacity

COAXIAL CABLE

4TM	4-tube coaxial cable with a potential capacity of 1920 telephone channels and 2 television programs
1T+(14M(60))	1-tube coaxial cable plus 14 multiconductor pairs using 60-telephone-channel multiplexing equipment

MICROWAVE RADIO RELAY

A	Microwave lines with a capacity of 1 television channel
B	Microwave lines with a capacity of 24 to 60 telephone channels**
C	Microwave lines with a capacity of 60 to 240 telephone channels plus television
D	Microwave lines with a potential capacity of 240 or more telephone channels plus television

*For purposes of this map Main Cable and Microwave Radio Relay lines are defined as those lines having a capacity of at least 24 telephone channels or 1 television channel.

**As many as 24 telegraph channels of 66 words per minute can be substituted for each telephone channel.

0 50 100 150 KILOMETERS
0 50 100 150 MILES

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